would obtain a competitive advantage in the downstream market through its favored relationship with WorldCom-MCI. Since the combined entity will have considerable freedom to set prices in an unregulated Internet, it will have an incentive and the ability to offer discounts that advantage AOL, and hence, itself. AOL will, in turn, have an incentive to accept these lower rates. In effect, by sharing a portion of its increased profits with AOL, and other large downstream ISPs, WorldCom-MCI may discourage their defection and thus may be able to continue to exploit other users.

AOL has already signed a five year contract under which WorldCom will become its largest network service provider.[34] Alliances between WorldCom-MCI and large downstream ISPs may serve to skew the incentives of these ISPs and render them ineffective in disciplining the market for backbone services.

8.2 Multihoming

In its ex parte presentation to the FCC on March 12, 1998, WorldCom argued that "Multihoming is Easy." An implication of this claim, if true, is that WorldCom-MCI customers can "easily", i.e., at low cost, connect to multiple backbone providers ("mulithoming"). If a substantial number of WorldCom-MCI customers were to avail themselves of the multihoming option, the number of Internet addresses available only through WorldCom-MCI would be relatively low, rendering harmless any threats by WorldCom-MCI to degrade the quality of its interconnection to, or to disconnect entirely from, other backbone providers.

This argument is most easily seen in the extreme case where every ISP is multihomed on every backbone provider. In this case, no backbone needs to be interconnected to any other backbone, and no backbone can behave anticompetitively by refusing to peer or otherwise interconnect with another backbone.

There is considerable evidence that multihoming is neither easy nor inexpensive. An end user, or ISP, with a single connection to an upstream provider can use a low-end router (such as a Cisco 2501), configure it with the Point to Point protocol (PPP), and point a default route to the upstream provider. PPP is a passive routing protocol, and is relatively easy to manage.

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34 http://www.perscberichten.com/pb2/overig/080997/worldcom.com

By contrast, an end user or ISP that multihomes must maintain separate connections to each upstream provider. The efficient management of these connections requires the use of more advanced routing protocols; typically, Border Gateway Protocol, version 4 (BGP4) is used. This protocol is complex to manage, and it imposes higher costs than PPP on both the customer and the upstream provider. The additional costs of running BGP4 vary with the specifics of a given situation. However, UUNET/WorldCom has asserted that these added costs are significant:

> *"Thus, we require all of our multiply-homed resale customers to maintain active BGP4 routing with UUNET. This includes customers who are singly-homed to UUNET, but who may have multiply-homed customers connected to them."*
>
> *"Our regular service pricing is based on certain estimates of actual customer line use and on estimates of the amount of time we will need to spend to support our customers. Because our wholesale customers have other customers connected behind them, their aggregate use of our backbone tends to be higher than what we see from our regular customers.* ***Also, the amount of work that we need to put into managing and configuring the routing for our wholesale customers is much more substantial than what we need to do for our customers.*** *Because wholesale customers use more of our backbone facilities and because they also place greater demands on our staff, we charge more for our wholesale services."*[35]

These two statements, taken together, amount to the assertion that multihomed customers are more expensive to deal with, and that the additional costs of dealing with them are passed on to these customers. According to UUNET/WorldCom, therefore, multihoming is not easy.

This conclusion is supported by others with routing expertise. One source begins a discussion of BGP4 and multihoming with a warning: "This is dangerous stuff. It's always best if you can test BGP configurations in a "lab" made up of a few Cisco 2501s before implementing them in a live network connected to the Internet. Unfortunately, there's no good reference on 'using BGP' to refer people to."[36]

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35 Taken from "UUNET Wholesale Service Description" at the UUNET Web site, http://www.usa.uu.net, downloaded on 3.26.98; emphasis added.

36 Avi Freedman, "BGP Routing Part I: BGP and Multihoming" downloaded from [http://ww.netaxs.com/~freedman/bgp.html on 3.19.98.

Multihoming is not, in fact, a common practice among ISPs. According to the June 1997 issue of Boardwatch magazine, a survey of 4,455 ISPs shows that there are, on average, 1.1565 connections to backbones per ISP. If we assume that no ISP purchases connectivity from more than two backbones, only 15.6 percent of downstream ISPs are multihomed. Since the data show some ISPs buying connectivity from three backbones, the extent of multihoming is even smaller. However, the proportion of multihomed sites is so small that the total Internet "value" accounted for by these sites is likely to be small as well.

There is another reason why the Boardwatch data may overstate the extent of multihoming. ISPs that serve customers in multiple cities have available several architectural alternatives for obtaining Internet connectivity for their customers. One is to deploy a (possibly leased) backbone interconnecting the nodes they have in all the cities they serve. The ISP could aggregate all its external traffic and deliver it to a single backbone provider from which it purchased transit. In this case, the ISP would be single-homed. In an alternative architecture, the ISP would not deploy its own backbone. Instead, it would purchase transit separately in each city that it serves, perhaps dealing with a different provider in each city. This might occur when ISPs in different cities merge with each other or are acquired by other ISPs. In such cases, each final customer will be reachable only through a single core backbone provider, but the ISP will appear in Boardwatch's database as a purchaser of multiple connections. This provides an additional reason why the Boardwatch numbers are likely to overestimate the extent of multihoming.

The low incidence of multihoming may arise for reasons other than the complexity and the costs outlined above. Smaller ISPs whose traffic justifies a single T1 (1.5 Mbps) connection to a backbone may not be able to afford the added expense of two fractional T1s to two ISPs. In addition, backbone providers offer a form of quantity discount: T1 connectivity is often 4 to 6 times as expensive as DS0 (64 Kbs) connectivity, even though the former connection has 24 times the capacity. Multihomed customers are not able to take advantage of the implicit volume discount.

Given the relatively high cost and low incidence of multihoming, the threat by the combined WorldCom-MCI to degrade its interconnection to, or to disconnect entirely from, another backbone is likely to be viewed as a credible threat. Thus, the technical feasibility of multihoming cannot be viewed as ensuring that the merged entity will lack market power. Moreover, even if multihoming were to limit WorldCom-MCI's market power, the costs would be substantial.

9. Conclusions

The proposed merger of WorldCom and MCI will adversely affect competition in the core Internet backbone market. Backbone providers negotiate interconnection agreements for access to each other's networks, where "access" consists of information on the routes reached through the backbone, and packet origination and termination services. Each backbone provider supplies access to its network and demands access to the networks of interconnecting backbone providers. Core backbone providers currently interconnect on a settlements-free basis with each other and charge a fee for interconnection to non-core backbone providers.

After the merger, WorldCom-MCI will have a greater proportion of internal traffic on its combined network than the separate WorldCom and MCI networks. As a result, the combined network will experience lower costs than the separate networks from degraded interconnection to, or disconnection from, other core backbone providers. WorldCom-MCI will, thus, have greater bargaining power in interconnection negotiations with other core backbone providers, and will be able to increase its competitors' costs by charging for interconnection. Other core backbone providers will pass on these increased interconnection costs to their customers, and prices to end users will rise, as a consequence. WorldCom-MCI's increased bargaining power could also be used to raise new barriers to entry. The combined entity could refuse to interconnect with, or could provide low-quality interconnection to, a potential core backbone entrant unless the entrant acceded to its demand for higher interconnection charges. Higher interconnection charges would raise the cost of entry. In addition, the scale of entry to the core backbone market would rise, since entering backbone providers would be at a bargaining disadvantage as long as they were considerably smaller than the merged WorldCom-MCI backbone. While the bargaining asymmetries between WorldCom-MCI and other backbone providers are difficult to quantify on the basis of publicly available information, the Commission may have, or may be able to request, specific information from WorldCom and MCI on the interconnection agreements currently in effect between their backbones and others. This information, together with the experiences of other backbone providers that were unable to obtain, or recently lost, their settlements-free peering relationships with either MCI or WorldCom, may enable the Commission to judge the likelihood that the merged entity will have the incentive and ability to raise prices in the manner indicated by our analysis.